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## *Executive Summary*

# **Command and Control, Intelligence, Surveillance, and Reconnaissance (C2ISR) Low Density/High Demand (LD/HD) Asset Strategy Study**

## **QUESTION**

Air Force emphasis on the Expeditionary Aerospace Force (EAF), with designated Aerospace Expeditionary Forces (AEF) as a force presentation tool, has highlighted the difference between LD/HD crews and crews of other, more plentiful Air Force assets. Operations Tempo (OPSTEMPO) and Personnel Tempo (PERSTEMPO) on LD/HD assets have increased with increased Air Force commitments. This spawned Air Staff and field study to examine ways to better align LD/HD assets with the EAF. This analysis addresses the 14 July 1999 Air Force's Board of Director's (BOD) question:

"Should the AF pursue procuring more HD/LD assets, and are there other ways (structural, doctrinal, organizational, etc...) the AF can address the OPSTEMPO problems of its crews and assets while meeting the demands of the joint team?"

## **CUSTOMERS**

The July 1999 AF BOD tasked the Air Combat Command Vice Commander to evaluate LD/HD OPSTEMPO and report back in time to brief CORONA FALL, November 1999. Subsequently, CSAF/CV tasked AFSAA to provide analysis support to ACC on this tasking. AFSAA's efforts were sponsored/monitored at HQ AF by AF/XOC and AF/XOI. AFSAA worked directly with ACC's Aerospace C2ISR Center (AC2ISRC) on the LD/HD OPSTEMPO issues and the development of an analytical model to examine and rank AC2ISRC coordinated alternatives.

## **SCOPE/LIMITATIONS**

The limited time to meet the CORONA FALL deadline constrained the total number of weapon systems that could be suitably addressed. The team concentrated on the C2ISR LD/HD systems [Rivet Joint, AWACS, JSTARS, U-2, ABCCC, Compass Call and Air Control Squadrons] and developed a methodology, which could be applied to all LD/HD systems in the Air Force. Note that this study did not address UAVs or space assets.

Potential solutions were solicited by the AC2ISRC from the Air Force major commands, Air Force LD/HD-C2ISR units and other agencies. The proposals addressed the following areas: Training and Simulator Initiatives, Aircraft Investments, Personnel/Manpower Investments, Reserve Integration, Capability Augmentation, CINC Appetite, Proportional Tasking, and Maintenance / Modification.

To evaluate different potential solutions, it was necessary to score the value of each solution versus that solution's cost. To get an overall value for a solution, we evaluated the solution based on its ability to 'Satisfy CINC' operational requirements and 'Satisfy Airmen' requirements and quality of life goals. To get a value for 'Satisfy CINC,' we made three categories: capability, sustain C2ISR architectures, and timeliness. To get a value for 'Satisfy Airmen,' we made five categories: train, organize, equip, job appeal, and feasibility. To compute a value in each of the

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categories, we worked with ACC and AC2ISRC to create one or more relevant measures. In order to conduct trade off analyses between different criteria, it was necessary to understand the relative importance between different criteria. The rankings of the importance of the criteria were developed using an Operations Research technique known as "value focused thinking". Relative weights were assigned to the different criteria based on inputs from senior management (Maj Gen Perryman, AC2ISRC/CC, and Brigadier General Robinson, AF/DXOC, senior officers in 12 AF and PACOM) and from action officers in AC2ISRC.

After the proposals were in, AC2ISRC and AFSAA hosted a scoring conference to evaluate each solution against the weighted criteria. The scoring conference was by LD/HD-C2ISR unit representatives, ACC, NRO, AIA, and the Air Staff. The attendees evaluated the proposals using available historical data and expert judgment. Combining the results of the Senior Leadership inputs with the scoring of the proposals resulted in a rank ordered list of alternatives. Costs were estimated by the Air Force Cost Analysis Agency and LD/HD-C2ISR Program Element Monitors (PEMs). To determine the most value that could be had for a limited budget, AFSAA conducted a linear integer programming analysis of benefit to cost (or "bang for the buck") to develop portfolios of solutions for various costs across the range of all studied LD/HD-C2ISR systems. The entire analysis was repeated for each LD/HD-C2ISR platform, individually, at AF/XOC's request using the aggregate model. The highest value proposals (in order) for the lowest estimated overall cost of just over one hundred and fifty million dollars were:

- Fill manpower authorizations and train more crews to create more CMR crews. The Rough Order of Magnitude (ROM) cost for these proposals was \$110 million.
- Increase the use of existing simulators in training (and substitute them for required in-flight training).
- Increase supply at a ROM cost of \$50 million.
- Streamline taskings at no additional cost.

## RESULTS AND AFTERMATH

AFSAA worked closely with AC2ISRC to provide on-call analysis for changes in the ACC briefing. At the October 1999 Board of Directors meeting, ACC was directed to focus entirely on providing solutions to fix OPSTEMPO. This differed from the fundamental objective of the AFSAA analysis -- to manage the LD/HD fleet -- where OPSTEMPO was a measure to capture the ability to satisfy airmen. Satisfying OPSTEMPO ignored the 'Satisfy CINC' operational requirements for Air Force capabilities, sustained C2ISR architectures and timeliness. For the CORONA FALL meeting on 3 November 1999, estimates for PERSTEMPO and crews needed to achieve EAF goals were calculated using AF/DP and unit inputs. ACC relied on AFSAA to build a more detailed case for the personnel solutions. AFSAA coordinated with the AC2ISRC and used additional data provided by AF/DP and unit representatives to prepare current PERSTEMPO estimates and projected PERSTEMPO estimates. ACC briefed these slides and recommended the Air Force fund additional crews and simulators.

Results from this study impacted the LD/HD OPSTEMPO decision made at CORONA FALL and specifically were praised as logical, actionable, and within the approved budget limits. Due to the effort put forth by the many participating units, the AC2ISRC, and Air Force Studies and

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<sup>1</sup> For example, see Keeney, Ralph L. *Value-Focused Thinking: A Path to Creative Decision Making*. Cambridge, Mass.: Harvard University Press, 1992, or see Kirkwood, Craig W. *Strategic Decision Making: Multiobjective Decision Analysis with Spreadsheets*. Belmont, California: Wadsworth Publishing, 1997.

<sup>2</sup> Winthrop, Michael F. *Technology Selection for the Air Force Research Laboratory Air Vehicles Directorate: An Analysis using Value Focused Thinking*. Air Force Institute of Technology, March 1999, p. 52-55.

Analyses Agency, several of the highest value to cost solutions were selected for funding in the next funding cycle.

## FINAL WORDS

In this study "Value focused thinking" and decision analysis tools were very helpful in quantifying the operator's intuition based on experience. This approach may be germane to a wider variety of management problems at the Air Staff and MAJCOMs.

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# **C2ISR LD/HD Asset Strategy Study**

## **of Investment and Organizational Solutions**

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*Air Force Studies and Analyses Agency*

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We give a special thanks to LtCol Caragianis (AC2ISRC) for his leadership and to the Unit, MAJCOM and Air Staff representatives who spent a great amount of their time to provide the inputs to the study.



## Issue Summary



- **Statement of the Issue:**

- **“Should the AF pursue procuring more HD/LD assets, and are there other ways ( structural, doctrinal, organizational, etc...) the AF can address the OPSTEMPO problems of its crews and assets while meeting the demands of the joint team?”**

BoD meeting 14 July 99

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A restatement of this issue statement is “How should the AF manage LD/HD assets to alleviate heavy OPSTEMPO and meet CINC demands.”

While this analysis initially began as a dilemma for the EAF Air Staff XO division since LD/HD assets didn’t fit into the AEF construct of 90 days TDY every 15 months, it concentrated on managing LD/HD C2ISR assets to help reduce OPSTEMPO and better meet CINC demand.



## Background/ Scope



- **AFSAA LIMFAC study foundation**
  - **AFSAA Study: *Integration of LD/HD into the AEF***
  - **Outgrowth of EAF Transition Workshop (Mar 99)**
  - **Study originally sponsored by AF/XOC and AF/XOI until BoD Tasking (Jul 99)**
- **Methodology applied to C2ISR LD/HDs**
  - RC-135V/W Rivet Joint
  - E-3 AWACS
  - E-8 Joint STARS
  - U-2
  - EC-130E ABCCC
  - EC-130H Compass Call
  - Air Control Squadrons

• Limited by time and scoring capability  
• Ready to expand if directed

The Air Force Studies and Analyses Agency developed a value model to score proposed across the board solutions, in an objective and quantitative manner. The AFSAA effort began at an EAF transition workshop sponsored by AF/XOP and hosted by AFSAA with a subgroup on LD/HD chaired by AF/DXOC. The group recommended a follow-on effort be chartered and the DXOC designated AFSAA as the analytic lead.

In June, AFSAA briefed the AF/XO and AF/CV (with AF/XOC and AF/XOI sponsors) on the methodology for building a C2ISR LD/HD strategy. Before a message was signed out, the AF board of directors tasked ACC/CV to lead a similar effort. ACC/CV tasked AC2ISRC. AC2ISRC requested AFSAA's analytical assistance to build the response for ACC/CV. ACC/CV briefed some of the study conclusions at Corona Fall.

AFSAA's effort covers only the C2ISR LD/HDs. This scope was due to time constraints in transitioning AFSAA's original study effort to the BoD issue.



## Assumptions



- **Aggregated results favor solutions which apply across the Air Force C2ISR LD/HD community**
- **Individual platform value improvements are not comparable across platforms**
- **Results assume solutions are fully funded**
- **Results are not trade-offs**
  - **Solutions are not substitutes for near term deliverables**

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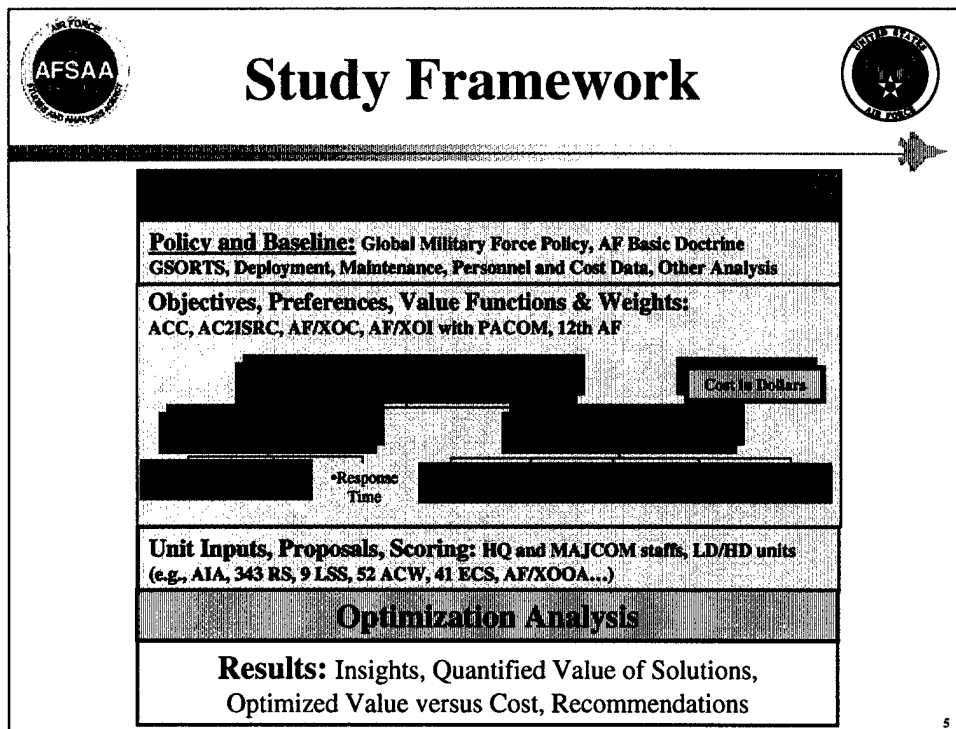
Before we discuss results, we want to define assumptions:

First we show study results which are ranked based on their cumulative affect on all C2ISR LD/HD assets. Individual platform solutions are given subsequently. An improvement of 30% in AWACS cannot universally be shown to be better than a 25% improvement in another platform (scorers valued proposals relative to other proposals for their platform only).

The routine created to optimize proposals for a given budget increments (i.e., to create portfolios of investments) makes a simplifying assumption that solutions are either fully or not funded.

Scorers assessed the benefits of solutions assuming they were added to planned C2ISR investment implementation. Solutions were assumed not to be substitutions for efforts already funded in the FY00 POM.

Solutions require further refinement to identify specific platforms which would benefit most, and the actual LD/HD asset cost of implementation versus ROM used for this study. Costs were supplied by Air Force Cost Analysis Agency (AFCAA) and LD/HD Program Element Monitors (PEMs).



We used a decision analysis framework to assess LD/HD solutions.

The process started with a value hierarchy which used doctrine and CONOPS to build a common framework to examine what was important in answering the tasking.

Working with Air Staff, ACC, and the AC2ISRC, we developed a value model using measures that are important to AF leadership. Weights for the upper level values were solicited from senior management (12 AF, PACOM, AC2ISRC and AF/XOC). At the lower levels, weights were solicited from the AC2ISR center.

The value model proposes to manage C2ISR LD/HD. Solutions, when implemented, must satisfy the CINC and the Airmen. Cost is evaluated separately as a constraint in the decision making process. AC2ISRC solicited proposals from the field and other agencies. Proposed changes were evaluated with respect to cost in light of budget constraints.

Operators were asked to estimate how solutions would change each of the measures listed. Relative to the current status. This was done at a scoring conference attended by the units (listed on slide 30), ACC, NRO, AIA and Air Staff.

Using the scores and historical data (where available), we captured the difference between the current baseline and level after implementation of the proposal (as estimated by the operators). This was input to the value model.

Using the model and analysis tools, we produced results which provide a series of best investment strategies at specified costs levels to implement effective proposals.



## Proposals Evaluated



- Training / Simulator
- Aircraft Investments
- Personnel / Manpower Investments
- Reserve Integration
- Capability Augmentation
- CINC Appetite
- Proportional Tasking
- Maintenance / Modifications

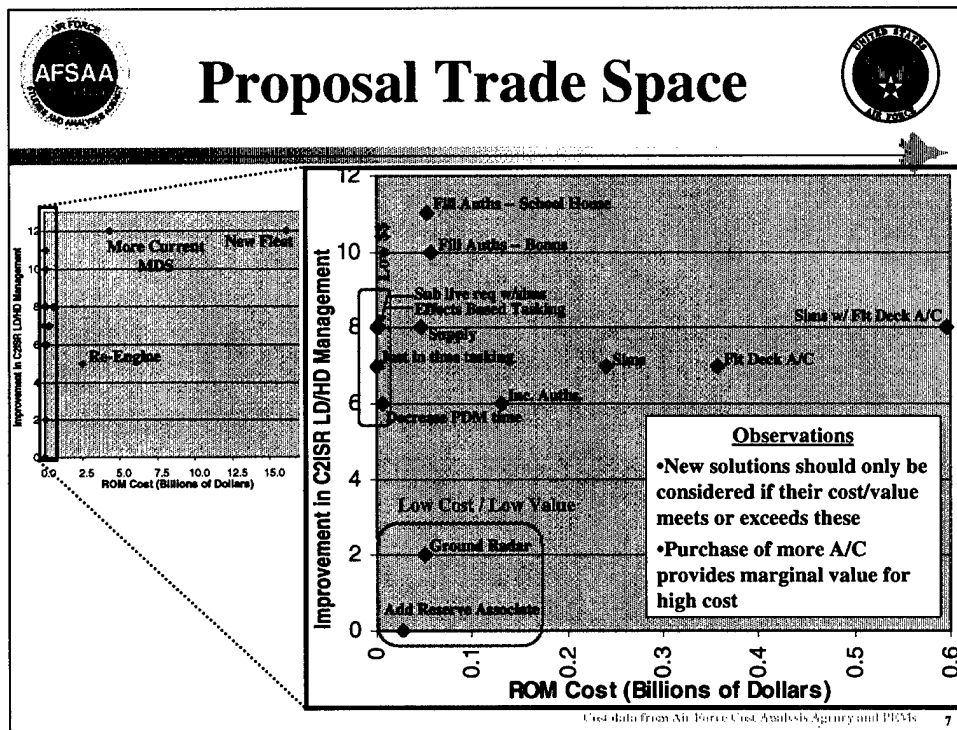
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The proposals from the units and MAJCOMs fell into these 8 categories.

After seeing how the proposals scored, the model helps to illuminate areas where proposals could claim more of the value “available” (i.e., increases from baseline that were deemed valuable by the operators who helped create the model).

Proposals did not address UAVs and Space which were deemed too difficult to assess operationally by the contributors. The proposed performance levels for UAVs and Space were not provided to them nor did the operators feel they could accurately predict their performance.

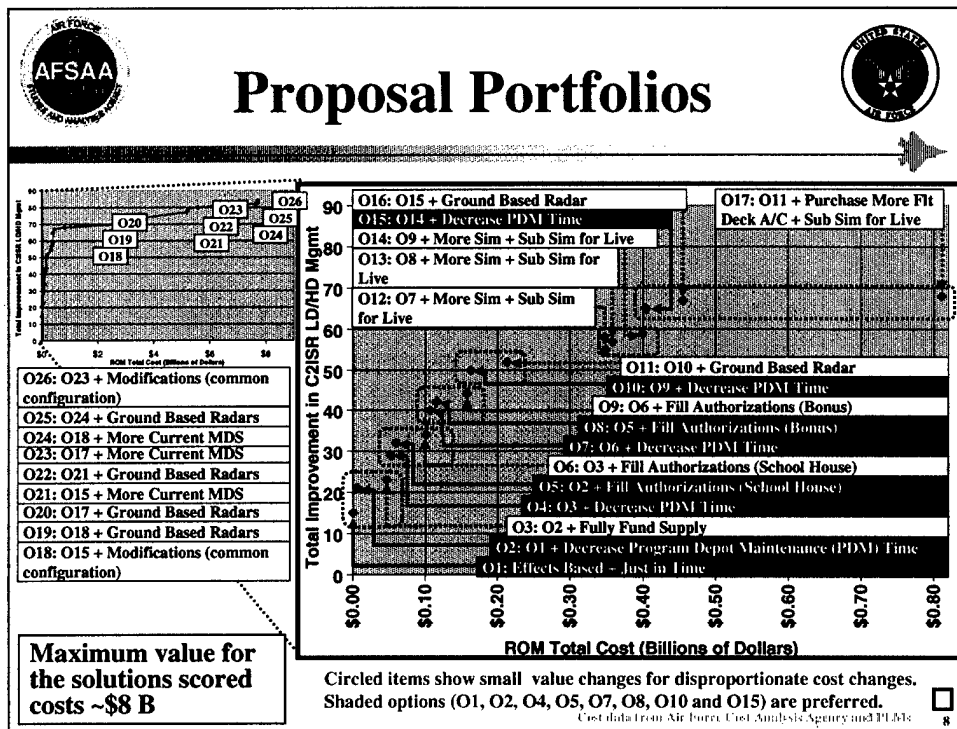
The full list of proposals is in slides 32-34 of the back-up charts.



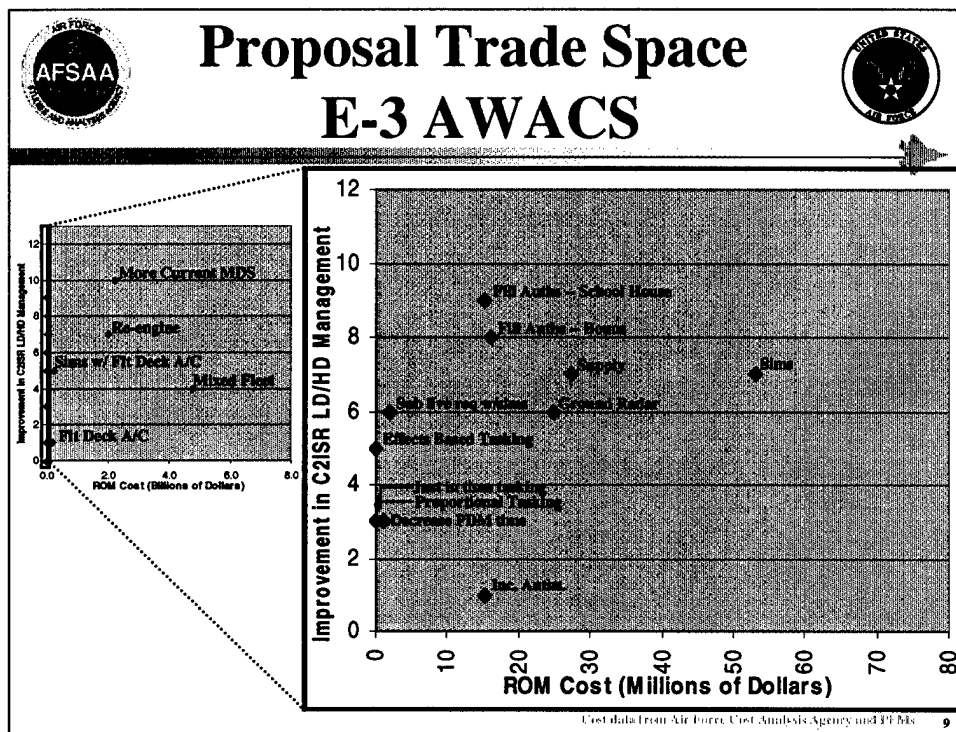
•This represents the solution space for the value change versus cost. The value is calculated after inputting the scores into the value model and applying the weights. It represents the overall improvement to CINCs and Airmen over the status quo.

•The graph on the top left corner shows the entire space and includes the high cost/high value solutions to the right. However, these solutions are not as good as many low cost/high value solutions highlighted in the red rectangle.

•The graph on the right shows the high value solutions that are low or very low cost solutions. These solutions provide high value, but at far lower cost. Hence, the decision maker should concentrate on these solutions to gain the largest value improvements for the least estimated cost. These solutions should be refined and better understood for the benefits they bring about and the actual cost incurred to implement them.



- Optimization techniques were used to find groupings (or portfolios) of solutions that provide the most benefit for various investments.
- The far left chart shows that increasing funds result in diminishing returns in value added. Moving farther to the right on the curve results in extremely large investments for only small improvements for LD/HD. The maximum amount of value that can be achieved with the current set of proposals costs approximately \$8B.
- Most of the value achievable is found for investments of less than \$1B. The chart on the right shows the solution space for the lower investment cost.
- Starting with Option 1 (O1): we show low dollar options which should always be pursued. O2 recommends adding the decrease PDM option to O1 if there are funds available. O5 shows that funding supply, decreasing PDM time, and increasing school house training to fill manpower slots is the most effective use of spending \$70 Million when looking across all the C2ISR assets.



We have applied the overall value model to specific C2ISR LD/HD asset. In doing this, we have assumed that the overall model applies to each LD/HD asset separately.

This is the first of the platform specific value versus cost charts. Like the aggregated charts, it starts with the whole solution space and provides a closer look at the solutions in the red box -- all of which are under \$60 Million.

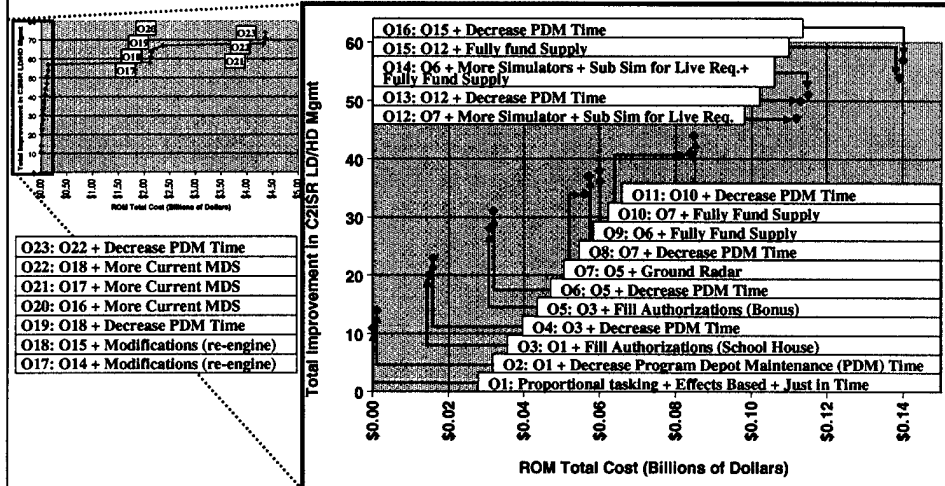
**Personnel:** AWACS shows that it can get the most benefit for small dollars by increasing its training and bonuses to fill manpower slots and improve retention. (If other ideas on how to help with personnel issues were recommended, they would likely score up here as well).

**Simulators (Sims):** Using the existing MS-Lite, the option to substitute live requirements for simulation could probably be partially implemented. Therefore, you may have to fund more simulators and expand MS-Lite before the value from substituting simulators for live is fully realized.

**Augmentation with ground based radar:** This solutions helps the ACS and the AWACS so the costs are split between platforms. The benefit of this augmentation are fairly high for the cost. The Aerostat (while not scored) may provide a similar benefit for similar costs.



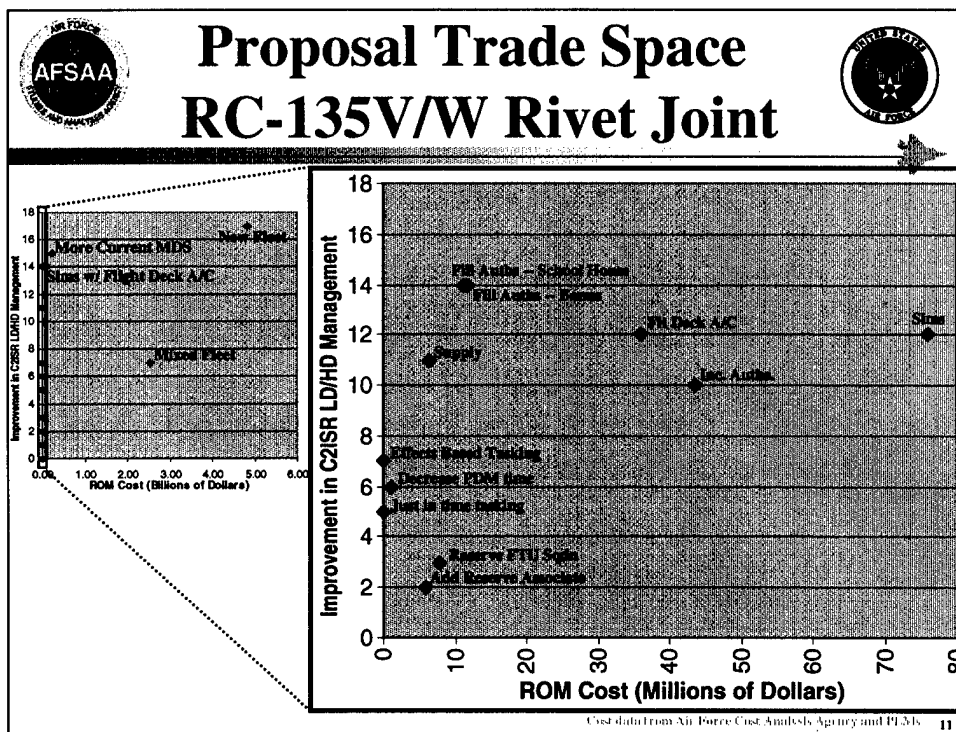
# AWACS Portfolios



AWACS has a number of solutions which can be pursued for \$140M or less. It is the only platform which gets significant benefit from the low cost option of having proportional tasking. This would ensure that 961st and 962nd ACCS covered contingencies according to their resource levels proportional to the Tinker units.

The material solutions are listed using the same notation as the overall C2ISR slide (e.g., Option 2 (O2) = O1 + the additional solutions).

Total cost to re-engine the 707 airframe is \$1.8 to \$2.2B with the CFM-56 engines. Total cost for Global Air Traffic Management (GATM), Block 40/45 upgrades for 33 A/C is at least another \$1.6B.



The obvious recommendation for Rivet Joint is to fund supply. While overall fill rates are often above 80-plus percent, high usage parts are still lacking and unavailable to fully support the mission. Rivet Joint lives out of their priority kits due to limited or no stock in the normal supply warehouse. This drives aircraft downtime, and increases cannibalization actions, reduces Non-Mission Capable Supply (NMCS) and Non-Mission Capable Maintenance (NMCM) aircraft status, and decreases aircraft turn-around time for local sorties and deployments.

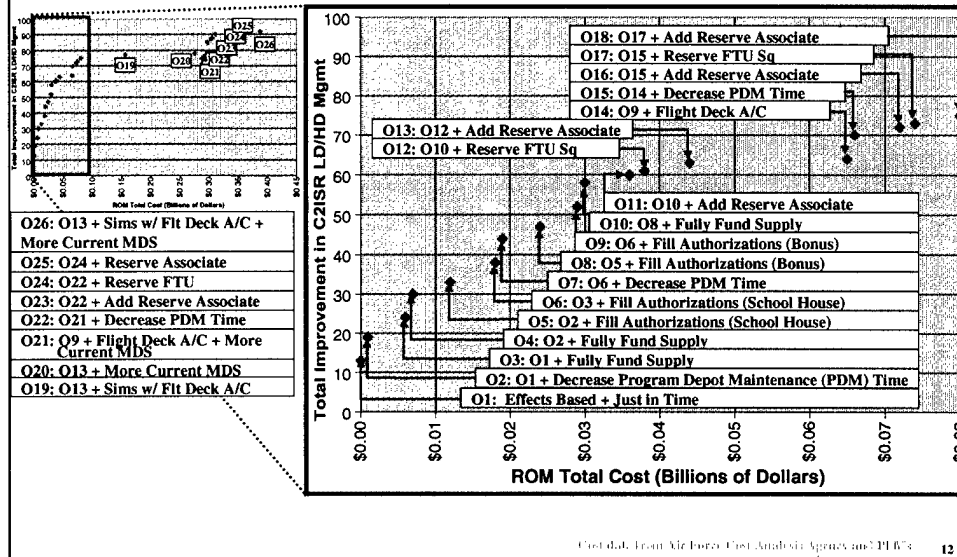
Another area to fund is the RC-135 Front-to-Back End **Simulator** Acquisition/Upgrade to RC-135 CFM-56 Simulator and Rivet Joint Mission Trainer (RJMT) to Distributed Mission Trainer (DMT) Compliance. Total Cost (Full Mission Simulation & Maintenance) is approximately \$38M (and some of this is funded already). This allows the RC-135 crews to participate in distributed simulated exercises with other aircraft while at their home station: Offutt Air Force Base.

The CFM-56 Simulator is partially funded. Modifications will need to be made to configure the simulator to DMT standards. The RJMT is funded, but is not fully ready for DMT integration.

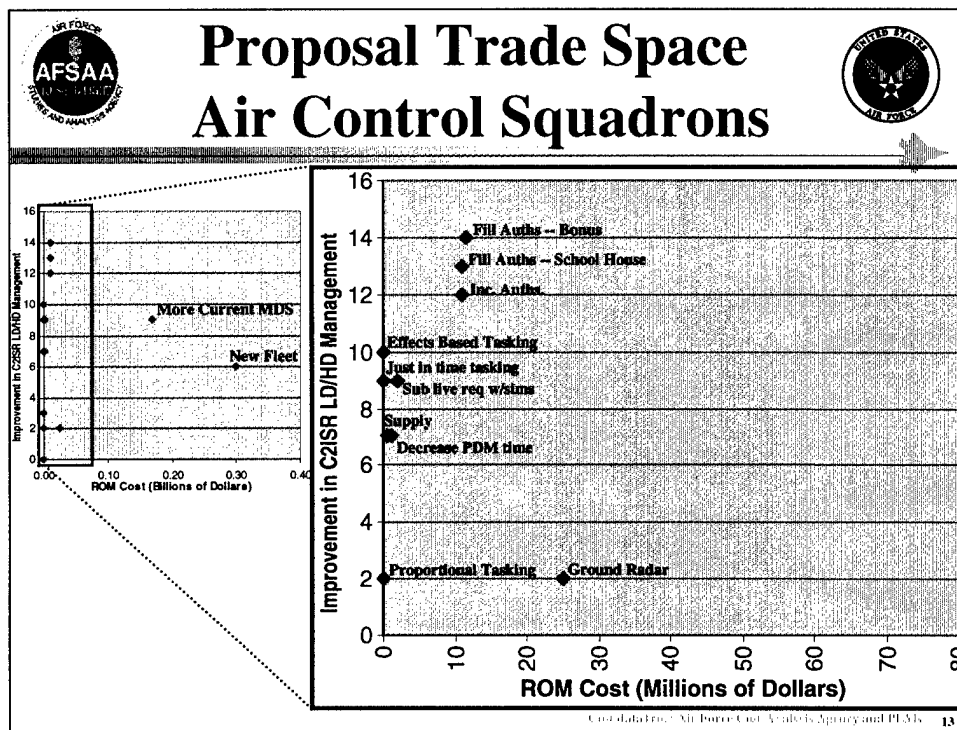
High value is also received from getting more **flight deck aircraft** for training and **two more MDS** (RIVET JOINTs 17 and 18) for relatively low dollars. The costs depend on being able to use existing airframe and performing the necessary modifications. For example, the figure of \$107.5M is being used to show the costs of modifying an aircraft. As a result, this option should be seriously considered despite it not showing up on the \$80 M or less chart. The Airborne Reconnaissance and Surveillance Architecture document, 15 Apr 97, indicates that 26 RJs are needed for current national strategy



# Rivet Joint Portfolios



- This chart shows the value that can occur from combining the solutions at various dollar thresholds. Option number 20, the increase MDS option, shows that even if this option is pursued, a number of other things should also be done. These range from increasing supply, training personnel and adding flight deck aircraft to decrease PDM. Another possibility is using the reserves to fill more missions currently covered by the active duty crews.
- The manning solutions are predominant in these portfolios.
- The unit focused on authorization increases. The 343rd Reconnaissance Squadron estimates its historical mission ready crew fill rate at 75 percent of authorized. From this and contingency deployment levels, they estimate their authorized manning needs to be at 150 to keep TDY within EAF TEMPO guide lines.
- If percent mission ready crews could increase, the same value would be realized. In either case, school house capacity such as the Electronic Warfare Officer (EWO) training at Randolph would have to increase.
- The 55th Wing could also benefit from a reserve associate unit.
  - Reserve Component have LD/HD skills that could be used to relieve personnel tempo on an individual level for the Active Component. It may also increase the Air Force's ability to respond effectively during major theater wars. The Reserve Component could provide back-fill to the active-duty reconnaissance units during small-scale contingencies.

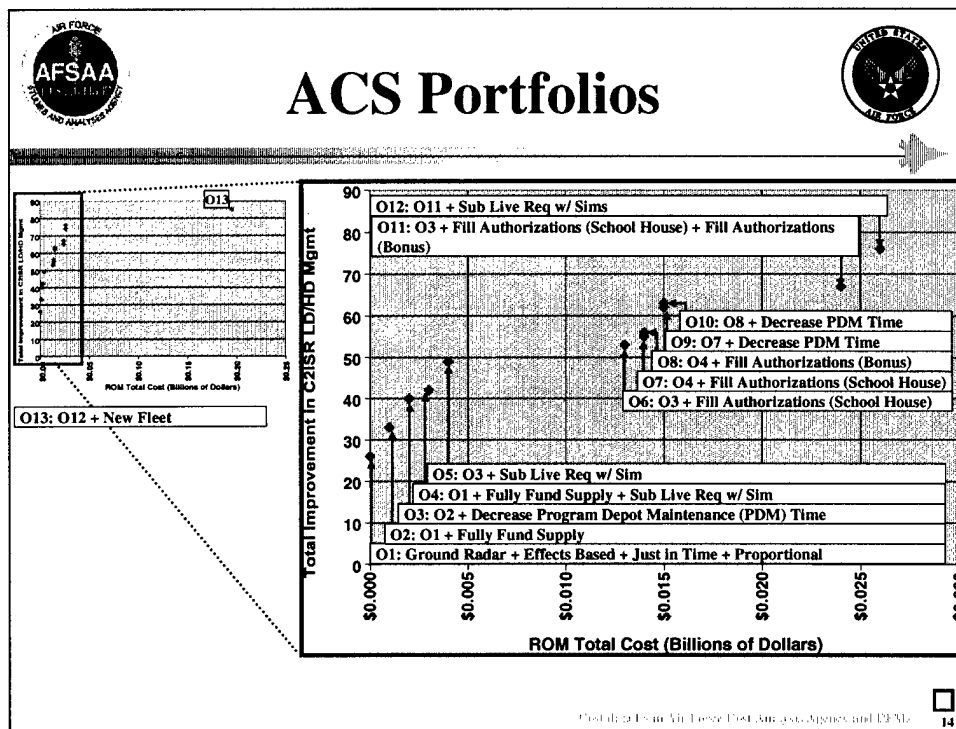


The original intent was to assess "GTACS" but the solutions were scored with assuming that the planned GTACS modernization was complete.

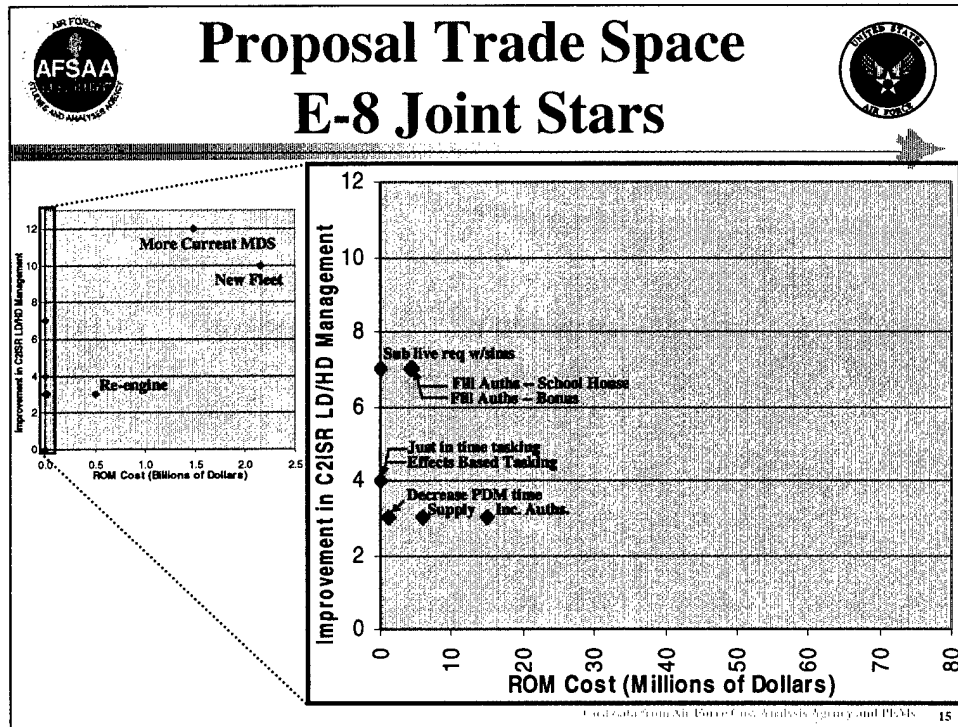
Currently, their **manning** is at approximately 16 out of 24 authorized crews. As a result, the "increase authorizations" was treated (scoring and costing) similar to the fill authorizations in focusing on training costs. Implementing ground based radars apart from the ACS configuration is primarily associated with reducing AWACS TEMPO. It may also provide some relief for the ACS crews if they are not assigned to support it. The cost of the new radar is divided between the ACS and the AWACS trade space charts.

Concept of Operations for tomorrow's system consists of Battle Control Centers (BCC) and Radar Communications Cells (RCC). BCC centralizes the operations that were at CRCs and CREs. BCCs conduct true distributed operations in an open system workstation environment. Scaleable UTCs will be configured for individual core competencies and CINC requirements. By deploying a BCC at a safe distance from the front line, the BCC if co-located, will be able to leverage from Main Operating Base (MOB) infrastructure and will also have the capability to operate independently. A major improvement of the BCC over current day equipment will be its multiple radar and sensor fusion capability consisting of tactical joint, coalition, host nation, and FAA radars as well tactical and national sensor assets.

The RCC will be a radar and communication for the BCC becoming its UHF, VHF, HF and TADIL node. Upgraded or fully replaced TPS-75's will provide robust theater missile, low observable, and cruise missile detection capability.



- The optimization charts show that investment thresholds of \$5 million, \$15 M and \$25 M provide decision points. The rule that substituting live requirements for simulators can occur only after buying more simulators kept this option off many of the other platform “low cost charts.” Since there is simulation capability inherent in the existing MCE vans, this can be pursued for little investment. If the BCC/RCC configuration does not have adequate simulation inherent, the value for substituting live requirements for simulation should have a higher cost than depicted.
- The full benefits may not be realized unless some of the recommendations of a concurrent ACC/XOY study (on DMT and resolution of fidelity to meet training requirements) are implemented to pave the way. The costs in this chart do not capture these recommendations.
- To establish new GTACS (CRC/CRE specific) training systems versus connecting old ones for leading up to DMT capability the modernization effort of ACS need to include additional training systems - \$500K per squadron. If there are 23-26 squadrons, that equals \$11-13M in 2-3 years. To help the trainers in the near term and additional \$3-5M over the next two years in voice and speech recognition, \$2-3M in cluster computing, and \$3-5M in Artificial Intelligent tutors, and tools may are recommended



JSTARS was unique in scoring improvements because they are still building up their MDS and have not yet experienced being at full strength.

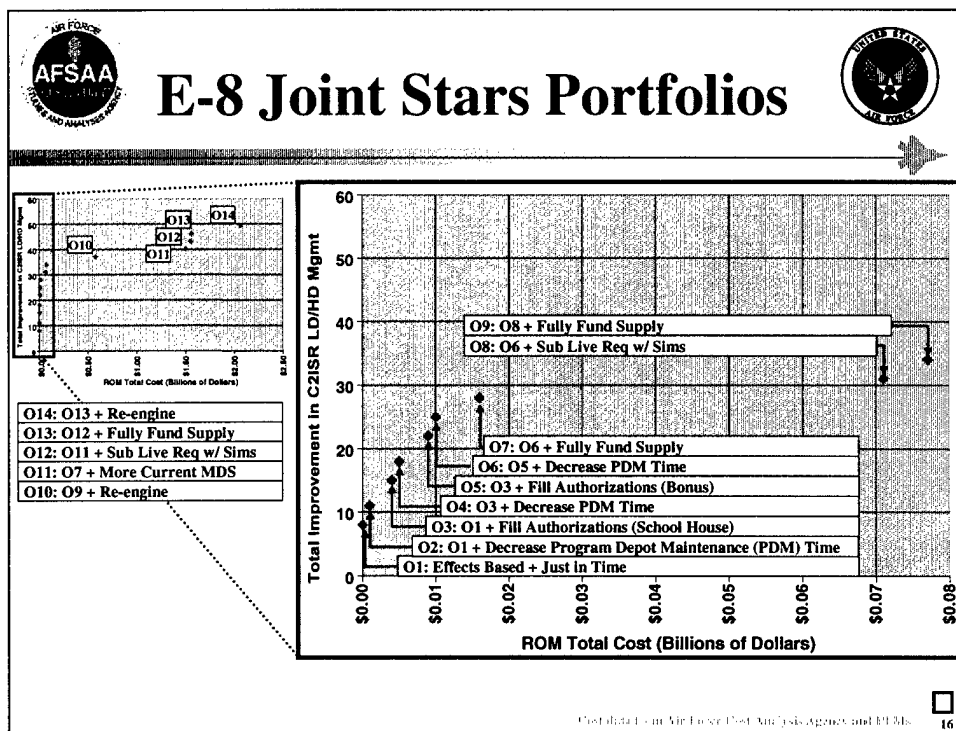
**Adjust crew ratios.** Change the ratio from 2 crews per aircraft to 2.5 crews.

**“Just in time ” versus “Just in case.”** LD/HD crews must be trained to rapidly deploy into any theater just in time to employ CINC required capabilities.

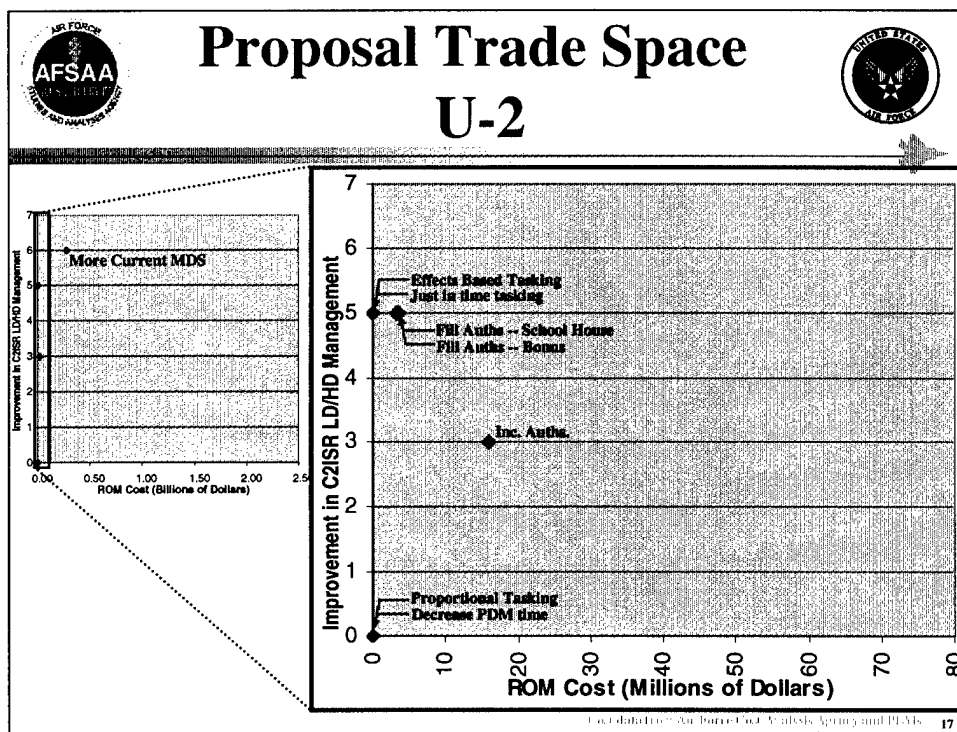
**Effects based tasking:** Theater CINC's should request JSTARS capability vice asking for a specific number of jets/crews. Chairman of Joint Chiefs of Staff (CJCS) should task by capabilities also. For example, tasking should be for 1 orbit, 18 hour coverage versus 2 jets and 4 augmented crews.

**Substitute Live Requirements with Sims:**

Unit representatives scored this option but not the option to increase simulators, as they are currently programmed to receive them. Their assumption was that use of high fidelity distributed simulations of the battlespace will improve realism training, upgrade readiness and allow testing of new concepts and strategies. They also advocated globally interconnected simulations to create training opportunities for near real time interaction between multiple agencies that expect to employ together, to supply a required and requested capability. With this ability, units at any location around the globe can train with forces in any theater without actually deploying there. Thus, TDYs are reduced and airframes and people experience lower OPSTEMPO and PERSTEMPO.



- With a few exceptions, JSTARS ranks solutions that are similar to those of other LD/HD assets highly.
- The JSTARS re-engineing option appears at around the \$500 Million threshold.
- **Re-engine the JSTARS aircraft.** Engines with greater thrust will allow for operation from airfields that have shorter runways. Operating from these airfields, which may be closer to the AOR, will decrease enroute time to and from the orbit area, saving costs in fuel usage, lowering the number of hours flown on the airframe, and shortening the duty day of the aircrews. Equally as important, new engines will allow operation at optimum mission altitudes to better employ the platform
- JSTARS also introduced recommendations to streamline training requirements:
  - **Evaluate Training.** Reevaluate training requirements directed by the Ready Aircrew Program and local directives. Determine if training events are required as frequently as currently directed. The end result is to ensure that the individual is proficient in the event while streamlining events and training assets to lower training costs and create efficiencies for the assets involved.
  - **Evaluate flying requirements for staff personnel.** Currently, many staff members maintain CMR status. With that status they are often required to augment the operational squadrons on deployments. It is true that they can offset the TDY rate for individuals by deploying in their place in the operations squadron, but in turn they leave a potentially critical opening in the staff function. Maintaining BMC status ensures that the individual is retainable at the wing performing staff duties vice deploying as a “crewdog.”

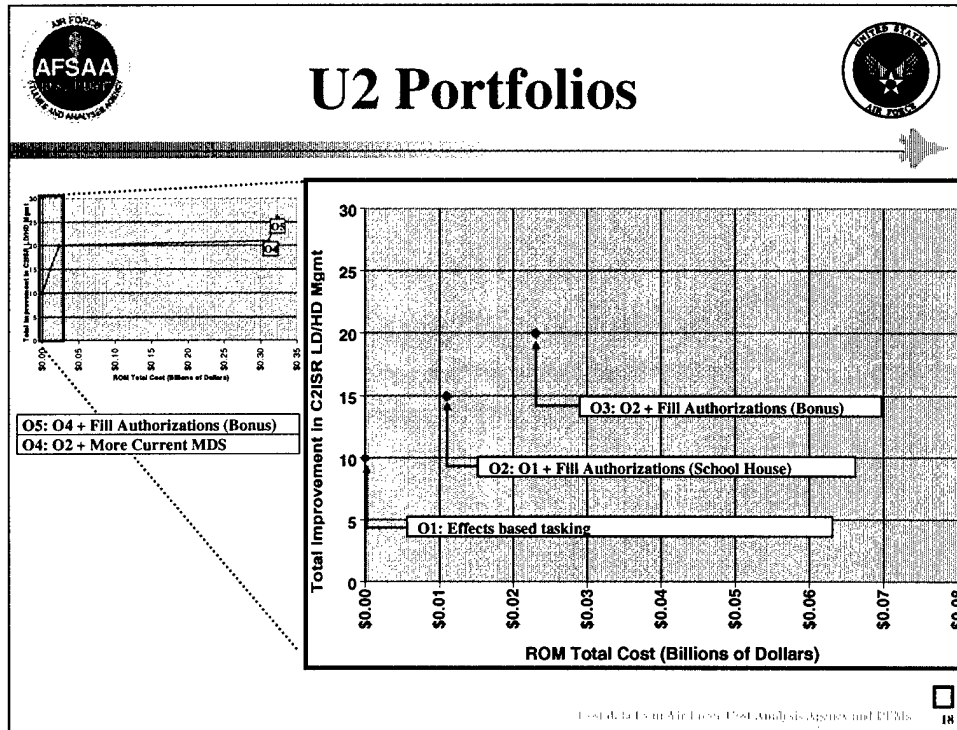


The U-2 scored fewer options than other platforms. New fleet and simulator proposals were not evaluated by the operators as options.

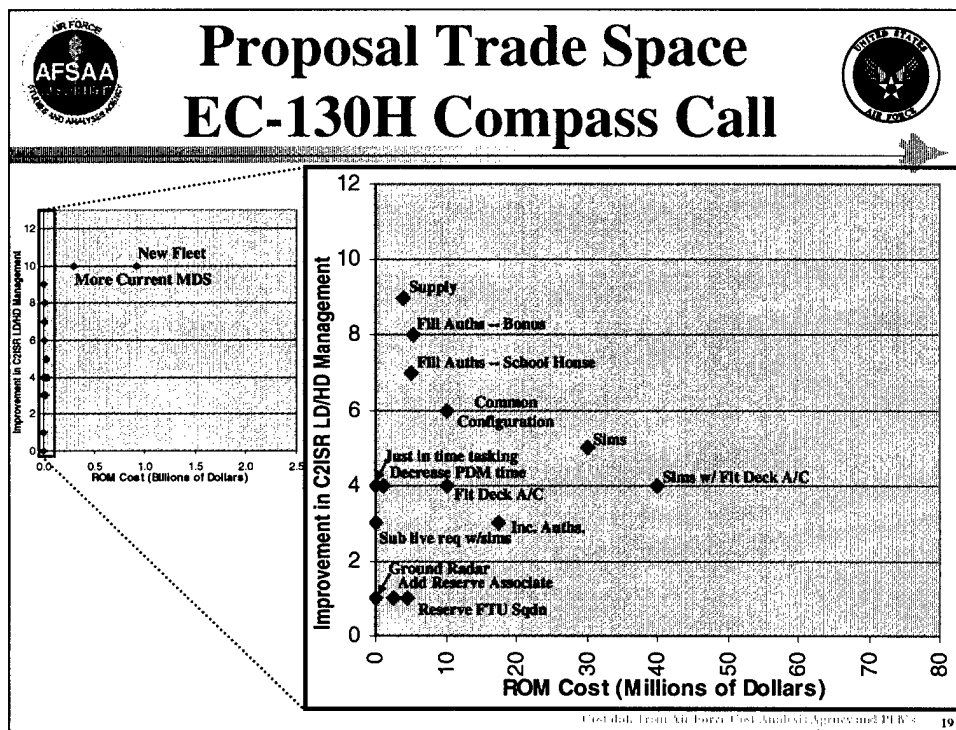
The solution to increase **authorizations** was based on going from 1.9 to 2.2 crews per aircraft.

The solution to **increase MDS** is going from 33 to 43 (with 5 of the 10 being assigned as PTAI).

One of the reasons that decreased PDM time was considered favorable by other platforms is because of the recent success story the U-2 had in cutting down this cycle time for little cost.



- Besides the organization recommendations that each LD/HD platform valued, personnel initiatives rank highly.
- Buying additional U2s are high cost but are one of the few options seen as potentially effective by the scorers.



Compass Call would realize the most value if it could ensure that **supplies** were more readily available. The cost estimate for spares was based on increasing the current expenditure on supplies by 1/3. If there are other ways to have a better fill rate than increasing the Operations & Support budget, these should be explored as well.

**Personnel / Manpower.** It also recommends additional authorizations and an increase of the crew ratio from 2 to 2.5.

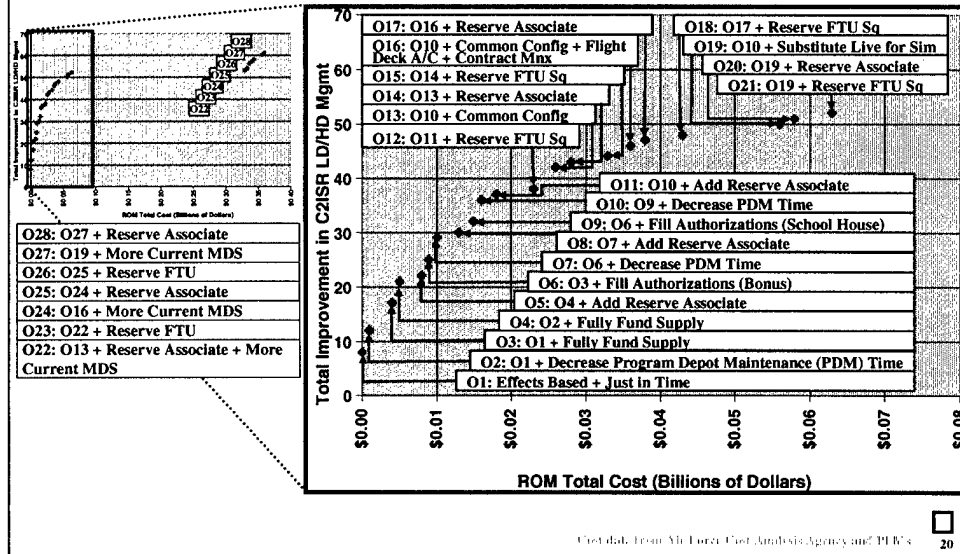
**Common configuration :** Accelerate the upgrade of the 43rd Electronic Combat Squadron (ECS) to block 35 to have common configuration with the 41st which just finished the block 30 upgrade. The budget includes \$20M over eight years. More money available up front to perform this task is preferable. The cost estimate was based on this rough assumption.

**Simulations:** Currently there is no range which can provide the robust emitter and language environment that the EC-130H, COMPASS CALL, mission crew requires to obtain full operational training. In addition, the Block 30 does not have a mission crew simulator to provide even a portion of this training on the ground. The plan to fund it in FY04/05 is late to need and will cause a gap in training devices available to maintain crew proficiency

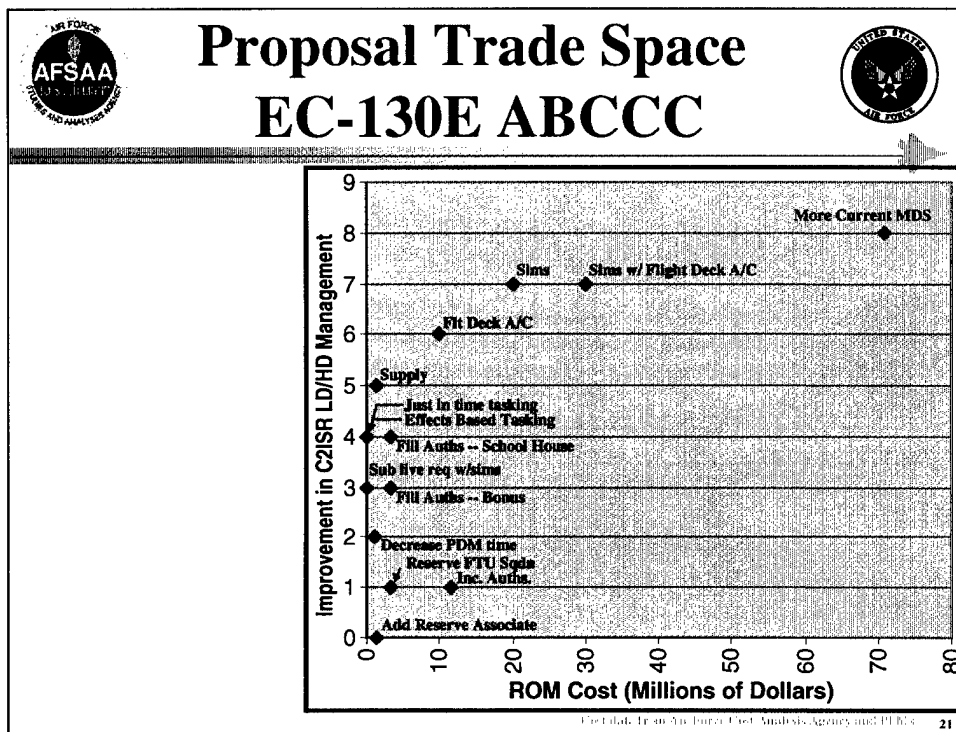
**Flight Deck Aircraft:** It also can modify flight deck aircraft for training for relatively low cost.



## Compass Call Portfolios



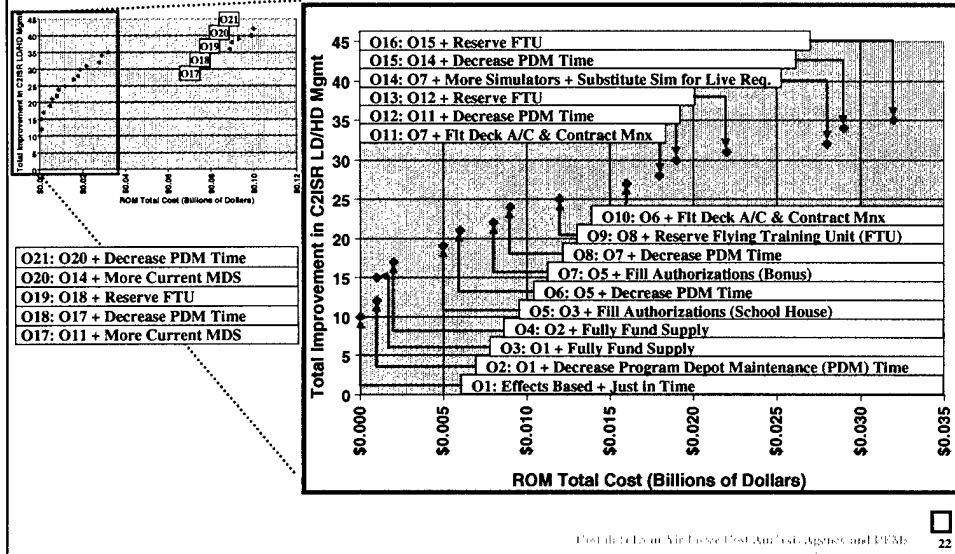
•In addition to the solutions highlighted on the previous chart, there are times when reserve associate units filling in for active duty personnel appear to help at a relatively low cost of approximately \$5 million. The use of a reserve FTU is scored as a separate option. Compass Call already uses contractor academics in training.



- ABCCC fit all its solutions in the “low cost” chart. This is because it did not expect to be able to justify buying many more MDS or a new fleet. Instead, the more MDS option was scored using an estimate of **2 more PTAI** coded aircraft. This would help the training problem they experience.
- Increasing **simulations** could have a similar effect for lower cost and slightly less value.



# ABCCC Portfolios



Portfolio is from Air Force Cost Analysis Agency and AFM



- The ABCCC portfolio also considers the use of reserves for squadron taskings and possibly as a FTU. It, like the Compass Call, also currently has contractor academics.



## Issue Responses



**“Should the AF pursue procuring more HD/LD (C2ISR) assets?”**

**YES BUT:** New *platforms* should only be pursued after school house capacity, simulators, supplies and ground based radars are increased.

**... and are there other ways ( structural, doctrinal, organizational, etc...) the AF can address the OPSTEMPO problems of its crews and assets?**

**YES:** Effects based tasking, just in time tasking, proportional tasking, simulator substitution

**... while meeting the demands of the joint team?”**

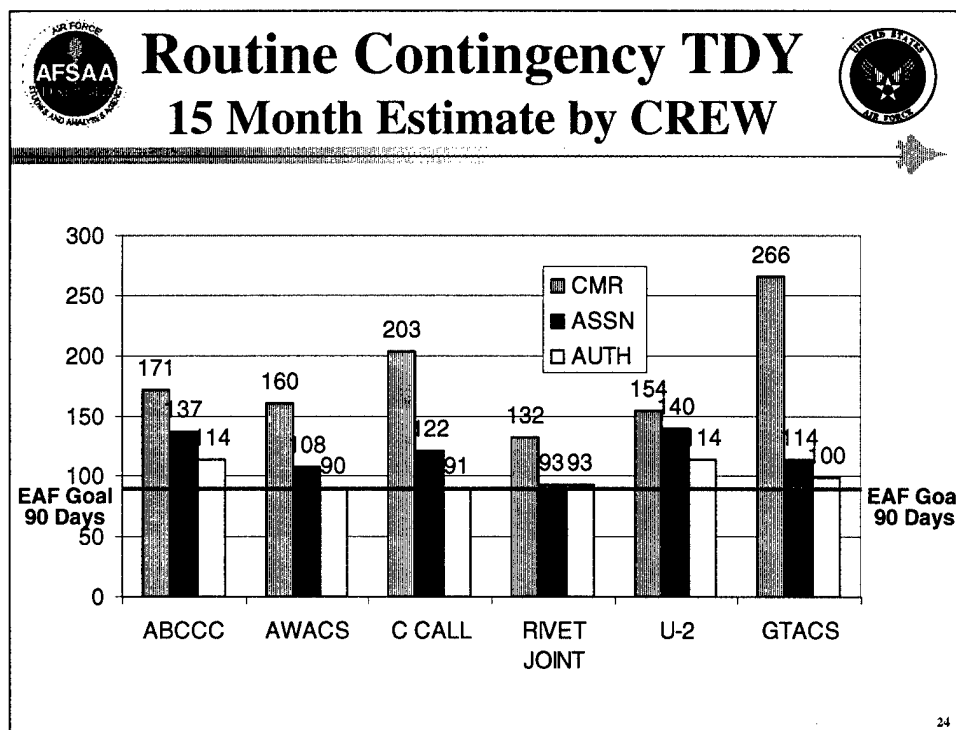
**YES:** All solutions improve or maintain AF ability to meet CINC requirements.

***“What manpower changes are needed to achieve EAF TEMPO goals?”***

***Estimates are provided in the following charts***

23



- The charts generally show that pursuing options prior to buying new aircraft will help the fleet the most cost effectively. High value options revolve around Improving Trained Crews Fill Rate (Simulators, School house capacity, Incentives) and Increasing Aircraft Availability (Supplies, Ground Based Radar, PDM time)
- Most of the solutions fit in the “other ways” part of the BoD question.
- All solutions are an improvement in the baseline capability of the CINC as perceived by the scorers.
- The last question was raised by several reviewers. It is only implied in the BoD issue statement. Our response is limited to the effect of PERSTEMPO on crews. Maintainers these units need their trained manpower increased as well, but we do not have deployment estimates for them.



After showing these slides to decision makers, the common question was -- how will these solutions help PERSTEMPO. In order to answer that question, we first calculate number of days available crews would be TDY for crews deployed routinely (ONW,OSW, other).

Estimation of the average days TDYs: (number deployed crews / number available crews) \* days in 15 months. The number of available crews is the only factor changing to find estimated days TDY.

As a result, this chart shows that if 100% of the authorized slots were CMR, the AWACS, Compass Call and Rivet Joint would be able to meet the AEF goal of 90 days contingency TDY every 15 months. This does not account for overlap of crews nor the current inability to train to 100% authorizations.

# Crews Required to Achieve EAF Goals

	<u>Auth</u>	<u>Asgn</u>	<u>CMR</u>	<u>CMR Req</u> <u>90 Days</u>	<u>Auth Req</u>	<u>Delta</u>	<u>MILPERS</u> <u>FYDP Cost (\$M)</u>
ABCCC	12	10	8	15	17	+5	\$24
AWACS	48	40	27	48	53	+5	\$38
Comp Call	20	15	9	20	22	+2	\$8
RJ	27	27	19	28	31	+4	\$32
U-2	54	44	40	68	75	+21	\$10
ACS	16	14	6	22	24	+8	\$131

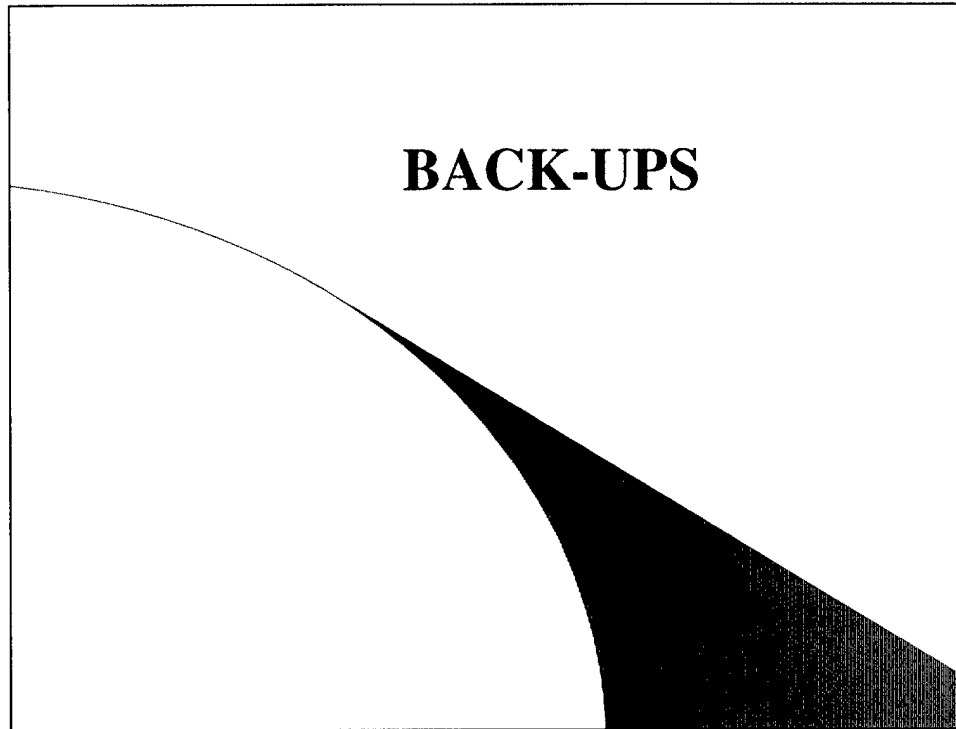
25

The first 3 columns provide the numbers of crews used in the previous chart. The "CMR Req" is the number of crews needed CMR to achieve the 90/15 goal. Using an optimistic estimate of being able to have 90% of your authorized crews CMR, we provide the number of authorizations which are needed. A MILPERS estimate through the FYDP is included. The total is \$443 M. This does not include training costs.

The Air Control Squadrons have a difficult situation that is not reflected on the chart.

- (1) In FY 01, ACC must cut manpower positions equivalent to 2 crews. (2) In FY02, USAFE and ACC must cut 4 crews, and then another in FY03.
- (3) Through reorganization, at the end of FY03, we will have three ACSs and a total of nine crews.
- (4) ACC is attempting a manpower recapture action in the FY02 POM/APOM, to get a fourth ACS with an additional three crews for a total of four ACSs and twelve crews.

To prevent a spike in ACS TEMPO, either the estimated number of crews deployed on routine TDYs to include CINC staff requirements (3.5) must change, or these cuts should be deferred (approximately 500 manpower positions).



The following charts were crated as back-ups to the presentation for more information on the administration of the study.



## Briefing Trail



### ■ Aggregate C2ISR LD/HD Results

■ AF/DXOC	10 Sep 99
■ AF/AXOC & AFSAA/CC	14 Sep 99
■ ACC/XPX	15 Sep 99
■ AF/XOC	17 Sep 99

### ■ Platform specific C2ISR LD/HD Results

■ ACC/XP (with AC2IRSC AO)	23 Sep 99
■ AFSAA/CC	27 Sep 99
■ AF/XOC & AF/AXOC	28 Sep 99

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This is the briefing trail by AFSAA for the study. AF/XOC has taken the insights from this study to CSAF on 12/10/99. The CSAF response was to task AF/XOC to create a strategy to meld each LD/HD platform as an organic piece of the 10 AEFs or 2 AEWs. He wants gaps between structure and capability and investments to meet capability required identified. AFSAA analysis is providing a starting point for the response.



## Mandate: Build a C2ISR LD/HD Strategy



- **Board of Directors Statement of the Issue**
  - Should the AF pursue procuring more HD/LD assets, and are there other ways (structural, doctrinal, organizational, etc.) the AF can address the OPSTEMPO problems of its crews and assets while meeting the routine demands of the joint team
- **Original Designation**
  - OPR: ACC/CV
  - OCRs: AF/XP, PACAF/CV, USAFE/CV, AF/XO, AFSOC/CV
- **Current Delegation**
  - Briefing: AC2ISRC for ACC
  - Analysis: AFSAA



The original purpose statement showing the analysis intent (to answer BoD question) and the changes in the Offices of Primary Responsibility (OPRs) and Offices of Corollary Responsibility (OCRs).



## Schedule



■ <b>Unit Histories Compiled</b>	<b>26 Jul 99</b>
■ Deployments, SORTS Data, Manning	
■ <b>Value Model Sessions</b>	<b>from 5 Aug</b>
■ <b>Proposals Turned In</b>	<b>17-20 Aug</b>
■ <b>Scoring Conference</b>	<b>24-26 Aug</b>
■ <b>ACC/XPX Interim Brief</b>	<b>15 Sep</b>
<hr/>	
■ <b>BoD Brief</b>	<b>5 Oct</b>
■ <b>Corona Brief</b>	<b>4 Nov</b>



This was the schedule for the study including the value model creation, population, and scoring as well as the interim and final briefing dates. Note that AFSAA completed the milestones through the ACC/XPX brief and ACC/CV briefed the BoD and Corona.



# Unit Representation



## ■ Units

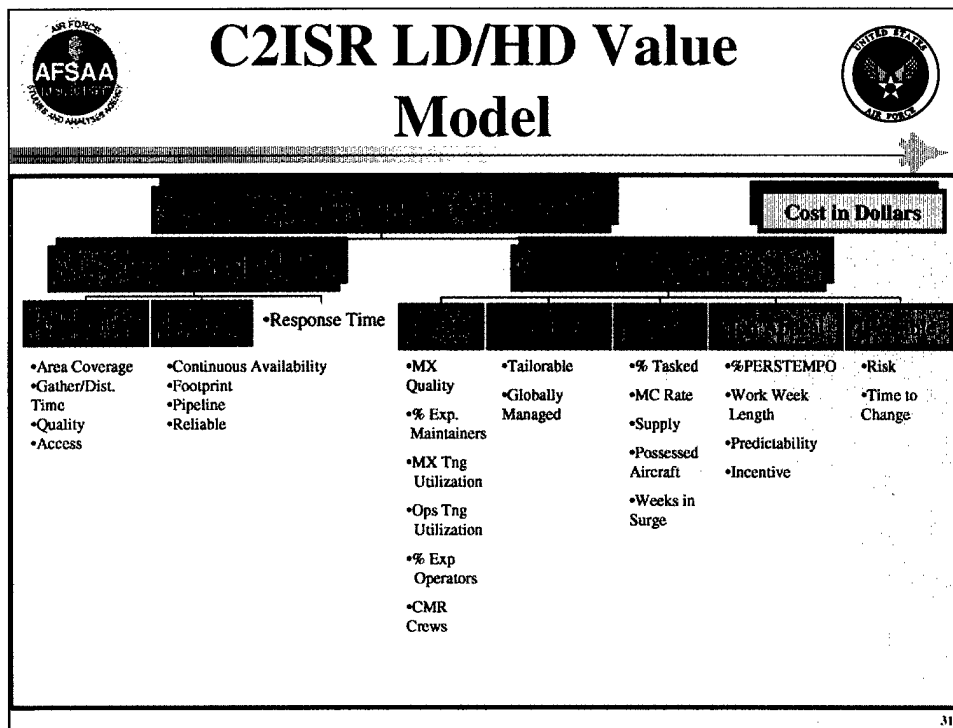
- AWACS (522 ACW, 970 AACs)
- JSTARS (93 ACW, 93AGS)
- RIVET JOINT (343 RS, 55 OSS, 38 RS, 67 OSS)
- U-2 (9 RW, 9 LSS, 9 OG)
- ABCCC (42 ACCS, 355 OG)
- COMPASS CALL (41 ECS, 355 OG)
- ACS (ACC/XOY)

## ■ Other

- ACC (XOF, XOI, XOY, XOZ, XRA, AC2ISRC)
- AIA (XPD, DOO)
- HQ USAF(DPF, XOCE, XOIR, XOOA, XPXP, RE)




Participants in the scoring conference and in building refining and reviewing the analysis.




This slide shows the complete value model. In order to manage C2ISR LD/HD, the solutions must satisfy the CINC and the airmen. Cost is recognized as a constraint to making changes.

Operators were asked to estimate how solutions would change each of the measures listed. Operators acknowledged their difficulty in giving exact figures. However, their scores reflect relative improvement of implementing the solution versus the status quo. They are used to determine the value of a solution, not the exact measure that would result from implementing the solution.

Whether you characterize the Airmen/CINC relationship as supply/demand or long term/ immediate needs, the value model helps us to see the factors involved in any of the LD/HD decisions. For example, the tasker could not be thought of as a charter to find out how to just "decrease PERSTEMPO" -- PERSTEMPO is a measure under satisfy airmen. Decreasing PERSTEMPO to zero would not only fail to satisfy the CINC but it would make the airmen unprepared to fulfill their roles in war and unmotivated to fulfill their duties in peacetime.




# Proposals





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A1	Purchase more simulators (Full Mission, Maintenance)
A2	Purchase flight deck aircraft with contract maintenance for training
A3	Purchase more flight deck aircraft and simulators (mixed)
A4	Substitute live requirements with simulation, expand capabilities of MS Lite
B1	New Fleet
B2	More of current MDS
B3	Mixed fleet
C1	Fill current authorizations (increase schoolhouse)
C2	Fill current authorizations (bonus)
C3	Increase authorizations and fill to 100% / increase crew ratio
D1	Add reserve associate
D2	Create separate reserve squadron to perform all Program Flying Training
E1	Augment with ground based radar
F1	Effects based tasking
F2	Just in time, just in case
G1	Proportional tasking
H1	Fully fund supply items
H2	Decrease Program Depot Maintenance time
H3	Modifications (re-engine, common configuration)



This is a list of the generated proposals which were scored using the value model.

- |    |  |
|----|--|
| A1 | Purchase more simulators (Full Mission, Maintenance)                         |
| A2 | Purchase flight deck aircraft with contract maintenance for training         |
| A3 | Purchase more flight deck aircraft and simulators (mixed)                    |
| A4 | Substitute live requirements with simulation, expand capabilities of MS Lite |
| B1 | New Fleet  |
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| G1 | Proportional tasking   |
| H1 | Fully fund supply items  |
| H2 | Decrease Program Depot Maintenance time                                      |
| H3 | Modifications (re-engine, common configuration)                              |

 <h1 style="text-align: center;">Proposals</h1> 		
	Title	Description
A1	Purchase more simulators (Full Mission, Maintenance)	Scores highly across platforms (except U2). ACS score rolled into A4.
A2	Purchase flight deck aircraft with contract maintenance for training	Scores highly across platforms (except U2, ACS)
A3	Purchase more flight deck aircraft and simulators	Scores highly across platforms (except U2, ACS)
A4	Substitute live requirements with simulation/robust, expand capabilities of MS Lite	MS Lite is an AWACS simulator that enables Distributed Mission Training (DMT). With this ability, units at any location around the globe can train with forces in any theater without deploying there. May not be able to do this option unless do A1 first.
B1	New Fleet	Total replacement of the platform. AWACS would purchase 28 new PMAI and 2 PTAI. JSTARS would purchase 19 new PMAI and 2 PTAI. Rivet Joint would purchase 18 new PMAI. ACS would purchase 8 BCC/RCC. ABCCC would purchase 7 PMAI and 2 PTAI. Compass Call would purchase 14 PMAI and 1 PTAI, although they are now upgrading their fleet. U-2 said this option was not applicable.
B2	More of current MDS	AWACS would add 6 PMAI and 2 PTAI. JSTARS would add 4 PMAI and 1 PTAI. Rivet Joint would add 2 PMAI. U-2 would add 10 PMAI and 5 PTAI. ACS would keep 8 MCE and not drop 3, as planned. ABCCC would add 2 PTAI. Compass Call would add 5 PMAI and 1 PTAI.
B3	Mixed fleet	Only scored by AWACS and Rivet Joint
C1	Fill current authorizations (increase schoolhouse)	This proposal has to do with filling authorizations (OPS and MX) by increasing school house throughput. Used a 25% increase.
C2	Fill current authorizations (bonus)	This proposal has to do with retaining current personnel (OPS and MX). Used the \$22K bonus figure.
C3	Increase authorizations and fill to 100% / increase crew ratio	Participants in the conference wanted to fill the authorizations they have on the books FIRST. Generally, having more people is better. In the case of maintainers, having trained crew managers is more important than increasing numbers. AWACS is limited by training not insufficient authorizations. JSTARS said they would increase their crew ratio from 2 to 2.5. Rivet Joint would increase their crew ratio from 2.2 to 3. U-2 would like to increase their crew ratio from 1.9 to 2.2. ACS would leave their current authorized crew ratio alone and fund 3, rather than 2. ABCCC would increase their crew ratio from 2 to 2.5. Compass Call echoed ABCCC.

This is a more expanded listing of the proposals.

	Title	Description
A1	Purchase more simulators (Full Mission, Maintenance)	Scores highly across platforms (except U2). ACS score rolled into A4.
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## Proposals (cont.)

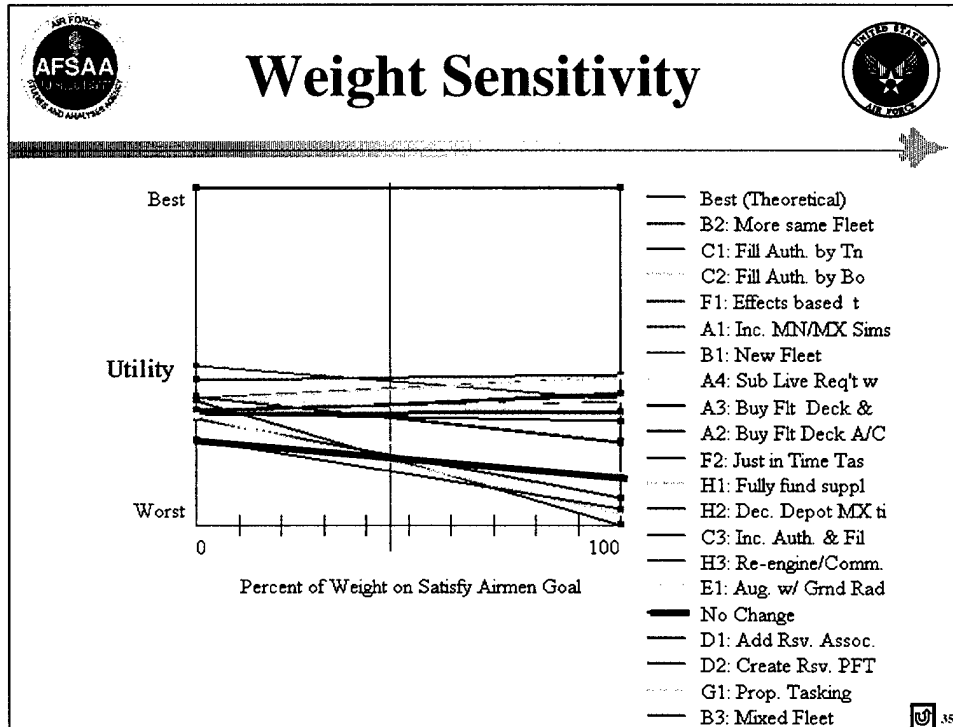


	Title	Description
D1	Add reserve associate	Reserve associates would be over and above current authorizations. AWACS is using them to train their three levels up to 5 and 7 levels. The active duty 5 and 7 levels deploy. JSTARS said they would not use a reserve associate. ACS said they are using the Guard now.
D2	Create separate reserve squadron to perform all Program Flying Training	Program Flying Training (PFT) would be performed by a separate reserve Flight Training Unit (FTU) squadron or contractors. AWACS, JSTARS, and Rivet Joint said this proposal would apply. U-2 and ACS said this proposal would not apply. ABCCC and Compass Call said they are using contractor academics now.
E1	Augment with ground based radar	Originally envisioned to encompass Unmanned Aerial Vehicles (UAV) and space, this proposal was narrowed to include only supplemental ground based radar for LD/HD missions. It's costs were included in the AWACS and ACS charts.
F1	Effects based tasking	This proposal was for effects based tasking over total force for contingencies and exercises (revalidation of CINC demands / education of JFACC staff).
F2	Just in time, just in case	LD/HD assets could be called on for contingencies from CONUS without being deployed continuously to a CINC theater.
G1	Proportional tasking	This proposal was geared to AWACS. PACAF deployed aircraft could be called upon to fulfill a CINC tasking.
H1	Increase supply items	Estimated costs by increasing supply funding by 1/3.
H2	Decrease Program Depot Maintenance time	Flight line processing had been speeded up by various other initiatives. This is to decrease the time in PDM not the scheduled times between maintenance.
H3	Modifications (re-engine, common configuration)	This proposal has to do with putting a new engine on old platforms (AWACS and JSTARS) and getting a common configuration of the platforms (Compass Call block upgrade for the 43 <sup>rd</sup> ).

34

This is a continuation of the proposals scored by the units using the value model.

	Title	Description
D1	Add reserve associate	Reserve associates would be over and above current authorizations. AWACS is using them to train their three levels up to 5 and 7 levels. The active duty 5 and 7 levels deploy. JSTARS said they would not use a reserve associate. ACS said they are using the Guard now.
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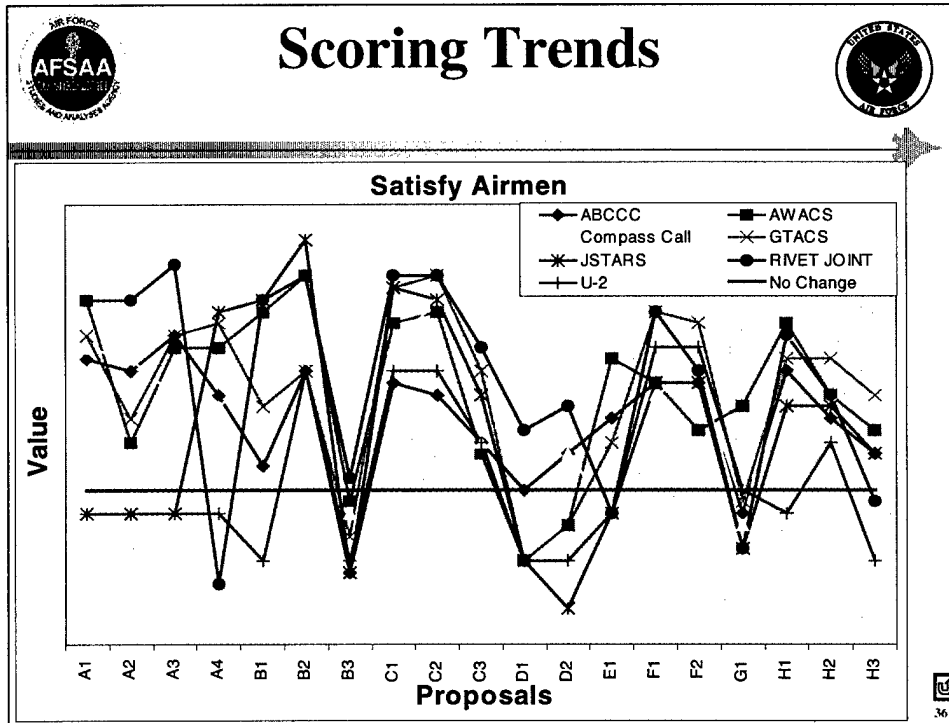
These results show that proposals to satisfy CINC and airmen are not in conflict. Most options that provided benefit to one also helped the other.

The line at 46% represents the amount of weight given to the satisfy airman value using a weighted average of the weights provided by the force providers, joint community and by the AC2ISRC (i.e., The CINC received 54%). Therefore, if all the weight were given to satisfy CINC, the line would be on the left axis. And, if all were given to the airmen, it would be on the right. For 100% of weight on satisfy airmen goal, options B2 (more same fleet), C1 (fill authorizations by training), and C2 (fill authorizations by bonuses) would be the top three options.

This chart also helps to show the process is robust to changes in the value weights. A new fleet (B1) provides the most capability for the CINC but it creates difficulties in the organize, train, equip (job and feasible) airmen values. Airmen prefer here to buy more of the same (B2) if possible.

Option B1 is on top only where the airmen gets 30 or less percent of the weight (CINC gets 70 or more). However, the percent weight on airmen was above that varying between 40% and 50%.

Therefore, solutions do not change significantly over the range of weights given and there is no need to determine which weighting is "right."



In addition to the weighting, the variation in scoring across platforms is important to examine. If representatives for different platforms disagreed whether a solution hurt or helped, the results could be distorted. Here, the majority of differences encountered were in the satisfy airmen measures (organize, training, equipment, job appeal, feasible). For example, the AWACS scores revealed that an increase in spares money (option H1) would increase the Airmen's value to 67 whereas the JSTARS scores resulted in an increase to 60. The exact value is not as important as the trend.

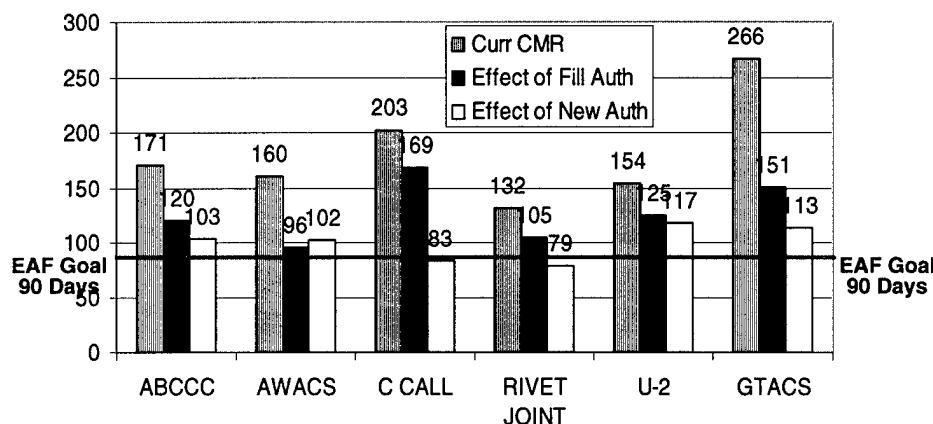
We see that platforms generally were consistent in scoring a solution as an increase or a decrease. As a result, we can be more confident that the solutions provided are good for the assets as a whole. There are exceptions where solutions offered were not desired for a particular platform, such as new MDS for ABCCC.



## Result of Scored Solutions on Contingency TDY Estimate



Units thought efforts to fill and train to current authorizations would increase CMR crews to the level graphed. Units requested new authorizations in the form of added crew ratio, but these only affect PERSTEMPO after operators are actually assigned and trained (2-3 years).



It is difficult to estimate changes in PERSTEMPO for solutions which are not implemented. At the scoring conference the best solution for the cost was increasing manning priority, school house training and bonuses to “fill authorizations.”

The red bar is the scorer estimate of the % CMR crews after efforts to “fill authorizations” are implemented. For example, Rivet Joint said CMR crews would increase by 20% (taking them from around 70 to 90% CMR). As a result, we use the new estimate CMR crews for the number available crews in the equation to estimate expected contingency TDY. Estimation of the average days TDYs: (number deployed crews / number available crews) \* days in 15 months. COMPASS CALL did not score this option of changing their number of CMR crews. This reflects the skepticism of personnel changes by the units.

Units provided estimates of desired **increased crew ratios** without using the EAF specific goals. The units changed their crew ratio recommendation as follows: RJ increased by 0.8, U-2 by .3, ABCCC, COMPASS CALL and JSTARS by .5. AWACS and GTACS said they did not see a benefit in increasing authorizations until the problem of filling the current personnel gaps is addressed. The yellow bar shows the estimated increase in the number of crews from this change. Assuming 90% of the crew increase become CMR and can be counted for the “number available crews,” we estimate the contingency TDY after this change is implemented.

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13. ABSTRACT (Maximum 200 words) LD/HD assets do not currently align within the Aerospace Expeditionary Forces (AEF), a cornerstone of the Air Force's new concept of employment called Expeditionary Aerospace Forces (EAF). OPSTEMPO and PERSTEMPO on LD/HD have increased along with increased Air Force (AF) commitments. Often times, training assets are pressed into operational service, further limiting the number of trained crew members, and sometimes negatively impacting crew morale and retention. The AF examined ways to orchestrate LD/HD with EAF. This analysis addresses the 14 July 1999 Board of Director's (BOD) question: "Should the AF pursue procuring more High Demand / Low Density (HD/LD) assets, and are there other ways (structural, doctrinal, organizational, etc...) the AF can address the OPSTEMPO problems of its crews and assets while meeting the demands of the joint team?" In early 1999, in response to issues highlighted at the AFSAA and AF/XOP EAF Transition Workshop, AFSAA developed an objective, quantitative problem statement of LD/HD and EAF alignment. The EAF Transition Workshop recommended follow-on study and AF/DXOC designated AFSAA as the analytic lead. The BOD and AF/CV concern over this issue resulted in AFSAA being tasked to provide analysis support to ACC's Aerospace Command and Control and Intelligence, Surveillance, and Reconnaissance Center (AC2ISRC). This led to the development of an analytical model to examine and rank AC2ISRC coordinated alternatives to improve OPSTEMPO for LD/HD C2ISR assets. AFSAA developed a value hierarchy and model to evaluate CINC requirements and AF's capability to manage LD/HD. Results from this effort were used in CORONA FALL 99 and received 4-star endorsement.				
14. SUBJECT TERMS Analysis, Low Density, High Demand, LD/HD, HD/LD, U-2, JSTARS, AWACS, Value Focused Thinking, Value Hierarchy, Operations Research, AEF, EAF, AFSAA, Study, Simulation, Optimization, C2ISR, OPTEMPO, PERSTEMPO, Air Force, AF, ISR			15. NUMBER OF PAGES	
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